CLAIMS:

1. A fluid switch giving three outputs from a three port, two position structure, actuated by an electrical supply which may be high or low to provide two of said outputs or switched, preferably rapidly, therebetween to provide the third output.

2. A fluid switch according to Claim 1 wherein the fluid is pneumatic fluid.

3. A fluid switch according to Claim 1 wherein the fluid is hydraulic fluid.

4. A fluid switch according to any one of the preceding claims wherein the fluid switch is a solenoid valve.

5. A fluid switch according to any one of Claims 1 to 3 wherein the fluid switch is a piezoelectric valve.

6. A fluid switch according to any one of the preceding claims wherein said structure comprises a switch member moveable by a control means to control flow of fluid through said ports.

7. A fluid switch according to Claim 6 wherein the switch member is moveable by said control means to allow flow through one port and prevent flow through a second port where the control means is in a first state and to prevent flow through the one port and allow flow through the second port where the control means is in a second state and to allow flow through a third port where said control means is alternated between said states.

8. A fluid switch according to Claim 7 wherein the control means is rapidly alternated between said states.

9. A fluid switch substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

10. A valve assembly having a fluid switch and a main valve for controlling fluid pressure in a working volume in three control states wherein the main valve has three ports for fluid, flow of fluid through a first port and a second port being controlled by the fluid switch being provided with an electrical signal in a first state or a second state respectively, and flow of fluid through the third port being controlled by alternating said signal, preferably rapidly, between said first and second states.

11. A valve assembly according to Claim 10 wherein the fluid is pneumatic fluid.

12. A valve assembly according to Claim 10 wherein the fluid is hydraulic fluid.

13. A valve assembly according to any one of Claims 10 to 12 wherein the electrical switch means comprises a two-position solenoid operated valve member.

14. A valve assembly according to any one of Claims 10 to 12 wherein the electrical switch comprises a two position piezoelectrically operated valve member.

15. A valve assembly according to any one of Claims 12 to 14 wherein the valve assembly is an ABS valve.

16. A valve assembly according to any one of Claims 10 to 14 wherein the valve assembly is an EBS valve.

17. A valve assembly according to any one of Claims 10 to 16 wherein the pressure supply to the fluid switch is drawn from the pressure supply to the main valve thereby making the flow into the control chamber partly proportional to the supply pressure.

18. A valve assembly according to any one of Claims 10 to 17 wherein build state is set when the electrical signal is off for a continuous period.

19. A valve assembly according to any one of Claims 10 to 18 wherein dump state is set when the electrical signal is on for a continuous period.

20. A valve assembly according to any one of Claims 10 to 19 wherein hold state is set when the electrical signal is alternated, preferably rapidly, between on and off such that the pressure in the control chamber of the valve remains within an intermediate range.

21. A valve assembly according to any one of Claims 10 to 20 wherein the valve is provided with ABS pressure control logic to control the fluid switch.

22. A valve assembly according to any one of Claims 10 to 21 wherein the valve is provided with operating parts having effective areas which provide characteristics, with respect to supply and delivery pressures, which compensate for the non-uniform proportion of supply pressure delivered by the

fluid switch when the electrical signal applied thereto has a constant high/low ratio and voltage.

23. A valve assembly according to Claim 22 wherein said characteristics are arranged to give a substantially proportional constant step build response across the range of operating pressures when a predetermined sequence of electrical signals is applied to the fluid switch.

24. A valve assembly according to any one of Claims 10 to 23 wherein the valve is an ABS valve and the valve has a normally open hold port holding the pressure in a delivery to a brake operating means when the hold port is closed and a normally closed exhaust port for connecting the delivery to atmosphere or to another low pressure region when the exhaust port is open.

25. A valve assembly according to any one of Claims 10 to 24 wherein the valve is an ABS valve and the valve has a normally open hold seat for holding the pressure in a delivery to a brake operating means when the hold seat is closed and a normally open exhaust seat for connecting the delivery to atmosphere or other low pressure region when the exhaust seat is open.

26. A valve assembly according to Claim 24 and Claim 25 wherein the ABS valve has three operating states, namely,

1. A pressure build state in which the hold seat is open and the exhaust seat is closed. This enables free flow of fluid from a supply to the delivery and from the delivery to the supply.
2. A pressure hold state in which the hold seat is closed and the exhaust seat is also closed. In consequence no flow between the supply and the delivery occurs but, preferably, flow occurs from delivery to supply if the supply is at a lower pressure than the delivery.

3. A pressure exhaust state in which the hold seat is closed and the exhaust seat is open. No flow occurs from supply to delivery but flow occurs from delivery to atmosphere.

27. A valve assembly according to Claim 26 wherein in addition to these three basic states, a slow build condition is normally required which can be achieved by alternating the operating state between the hold and build states.

28. A valve assembly according to any one of Claims 10 to 27 wherein the valve is an ABS valve and the three control states comprise a build, hold and exhaust state.

29. A valve assembly according to Claim 28 wherein the build pressure state is when the solenoid is de-energised for a continuous period and the pressure in the control volume is less than a predetermined percentage of the supply pressure. Said predetermined pressure may lie in the range 5% to 50% and is preferably 20%.

30. A valve assembly according to Claim 28 wherein the exhaust pressure state is when the solenoid is energised continuously and the pressure in the control volume is greater than a predetermined percentage of the supply pressure. Said predetermined pressure may lie in the range 70% to 95% and is preferably 80%.

31. A valve assembly according to Claim 28 wherein the hold pressure state is when the solenoid is switched on and off rapidly such that the pressure delivered from the solenoid is about 10% to 90% of the supply pressure and preferably about 50%.

32. A valve assembly having an electrically operated fluid switch control device having two seats and a switch member movable alternatively into sealing engagement with the seats to connect a control chamber of a main valve to a supply of fluid under pressure when the switch member is in a first position and in engagement with one seat and to a low pressure region when the switch member is in a second position and in engagement with the other seat, a body of the main valve having a first chamber in which a first piston is mounted for movement under the influence of fluid pressure in the control chamber, a second piston movable in a second chamber provided in the first piston under the influence of fluid pressure in a supply port, the second piston being movable into engagement with a third seat provided on the first piston to control passage of fluid from a delivery to an exhaust and being movable into engagement with a fourth seat provided on said body to control passage of fluid from a supply to the delivery and a control means to energise the fluid switch to position said switch member

a. in said first position

b. in said second position

c. to alternate the position of the valve member between said first and second positions.

33. A valve assembly according to Claim 32 wherein the internal dimensions of the valve are such that the valve enters each of the three control states depending upon the proportion of the supply pressure which is passed to the control volume.

34. A valve assembly according to claim 32 or claim 33 having an adjuster device for adjusting the volume of the control chamber.

35. A valve assembly according to claim 34 wherein the adjuster device comprises an adjuster piston moveable in an adjuster chamber which is connected to the control chamber whereby the volume of the control chamber may be modified by adjustment of the adjuster position in the adjustment chamber.

36. A valve assembly according to any one of the claims 32 to 35 wherein a device is provided to accentuate the pressure across the second piston.

37. A valve assembly according to claim 36 wherein the device comprises a shuttle or valve connected in functional association with the supply port to permit of a greater flow of fluid into the supply port than out of the supply port.

38. A valve assembly according to claim 37 wherein the shuttle valve comprises a valve member wherein, when the flow is into the supply port, the valve member occupies a position in which fluid may flow around the outside of the valve member whilst when the flow is out of the supply port the valve member may occupy a position in which flow of fluid around the outside of the valve member is restricted or is prevented.

39. A valve assembly substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

40. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.